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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re PATENT APPLICATION of:

KADNER *et al.*

Appln. No.: 08/958,865

Filed: October 27, 1997

FOR: THE PROCESS FOR PRODUCING ALUMINUM OXIDE BEADS

Group Art Unit: 1103

Examiner: STRAUB, G.

APPEAL BRIEF UNDER 37 CFR § 1.192

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

Date: December 30, 1999

Sir:

Pursuant to the Notice of Appeal filed on November 3, 1999, applicants submit herewith their Brief under 37 CFR § 1.192, filed in triplicate.

(1) Real Party Interest

The real party interest is the assignee Egbert Brandau, who resides in Alzenau, Germany.

(2) Related Appeals and Interferences

There are no related appeals pending or on file in the U.S. Patent & Trademark Office.

(3) Status of the Claims

Claims 19-23 as amended in applicant's response of March 24, 1999; claims 24-25, as added in applicant's response of January 22, 1998; claim 26 as amended in

applicant's response of September 13, 1999; and claim 27 as added in applicant's response of March 24, 1999, are pending in this appeal.

(4) Status of the Amendments

Subsequent to the June 4, 1999 Final rejection (hereinafter, "Paper No. 33"), claim 26 was amended to place the claim in independent form by incorporating the language of independent claim 19.

(5) Summary of the Invention

The present invention is drawn to a novel process for the production of substantially spherical aluminum oxide beads. The process involves passing an acidic aluminum oxide solution or an acidic aluminum oxide suspension through a vibrating nozzle plate, which produces aluminum oxide (i.e., hydrosol) droplets that fall from the nozzles of a vibrating plate. The falling droplets pass through an ammonia gas stream, which is blown laterally against the falling droplets, in order to evenly gel the surface thereof into a substantially spherical shape. The droplets then fall into an aqueous ammonia solution, in which the droplets are coagulated to form substantially spherical aluminum oxide beads. The aluminum oxide beads are then removed from the solution. In another embodiment of the present invention, the ammonia gas is blown onto the falling droplets from the interior of an annular arrangement of the nozzles from which the droplets fall.

(6) Issues

The issue for appeal is whether claims 19-27 are obvious under 35 USC § 103(a) over the combination of Bezzi (U.S. Patent No. 4,285,645) taken with Takumi (U.S. Patent No. 4,309,312) and Sanchez (U.S. Patent No. 4,179,408), this combination taken with Landis (U.S. Patent No. 4,190,622) and De Haven (U.S. Patent No. 2,968,833).

(7) Grouping of the Claims

Claims 19-27 stand or fall together.

(8) Arguments

The Examiner continues to hold claims 19-27 obvious under 35 USC § 103(a) over the above-stated reference combination, wherein the Bezzi reference is the primary reference. Applicants assert, however, that the Examiner has not established a *prima facie* case of obviousness for the reasons discussed below.

Bezzi Does Not Teach Or Suggest Applicant's Claimed Embodiments

Examiner alleges in Paper No. 33, at page 3, lines 15-20, that even though Bezzi (*i.e.*, the primary reference) does not explicitly recite the formation of the claimed aluminum oxide beads, the method for making metal oxide beads disclosed by Bezzi renders the present invention obvious.

Bezzi teaches the formation of metal oxide beads, specifically uranium oxide, from the chemical conversion of a solution of uranyl nitrate. See the Example at column 3. Referring to the drawing and the Example in Bezzi, the process is carried out where a solution of uranyl nitrate located in a header (A) is formed into droplets by the vibration of a header (A), wherein the droplets fall through a single hole in a perforated disk (3) located inside the header (A). The falling droplets pass through an anhydrous ammonia reactive gas atmosphere emerging from distributor (B). The ammonium reactive gas reacts with the uranyl nitrate to begin the chemical conversion of the uranyl nitrate to uranium oxide which initiates solidification of the falling droplets. The solidification and conversion is completed when the falling droplets come into contact with a reactive liquid which is ammonium hydroxide.

In contrast, the process for producing substantially spherical aluminum oxide beads according to applicants' present invention, as defined by claims 19-25 and 27, comprises the steps of:

(i) passing an acidic aluminum oxide sol or an acidic aluminum oxide suspension through a vibrating annular nozzle plate having at least 10 droplet nozzles, so as to form falling hydrosol droplets;

(ii) laterally blowing ammonia gas against the falling hydrosol droplets so that the surfaces of the falling droplets are substantially evenly gelled in a substantially spherical shape,

(iii) allowing the falling droplets to drop into an aqueous ammonia solution and coagulate to form substantially spherical aluminum oxide beads; and

(iv) collecting the aluminum oxide beads from the aqueous ammonia solution.

For the invention as defined by applicants' claim 26, the ammonia gas is blown against the falling aluminum oxide droplets from the interior of the annular arrangement of the droplet nozzles.

Applicants assert that the process of the present invention is distinguished from the method of Bezzi, in that Bezzi is silent with respect to (i) the formation of aluminum oxide beads, and (ii) the use of an annular nozzle plate having at least 10 droplet nozzles, where in one embodiment of the present invention (iii) the ammonia gas is blown against the falling aluminum oxide droplets from the interior of the annular arrangement of droplet nozzles.

The present invention is further distinguished in that the product aluminum oxide beads are formed from an aluminum oxide solution without a chemical reaction taking place to form the aluminum oxide beads as the droplets fall. In contrast, the process of Bezzi subjects the falling droplets first to a reactive gas, and then a reactive solution. The falling uranyl nitrate droplets are thus converted to uranium oxide beads by a chemical reaction. No such chemical reaction occurs in the method of the present invention.

Bezzi Does Not Teach Or Suggest The Formation Of Aluminum Oxide Beads

The Examiner asserts that while Bezzi does not specifically teach or suggest the formation of aluminum oxide, it would have been obvious from the teaching of Bezzi to make the aluminum oxide. Specifically, the Examiner states that:

> While Bezzi et al [-645] does not specifically recite alumina bead manufacture, it would have been obvious to one of ordinary skill in the art of metal oxide formation ... who is well aware that [aluminum] oxide beads are routinely made by gelling droplets[,] to employ the process of Bezzi et al. to make alumina beads from an alumina precursor feed solution. This is considered particularly obvious since in column 1, lines 8-9 and 49-50 of Bezzi et al. teaches to employ his process to make spherical particles for catalyst [supports], which [ ] are commonly [made] of alumina.

See Paper No. 33, page 3, lines 15-20. The Examiner's statement, however, is based on an *obvious-to-try* rationale, which is not the proper standard of obviousness under 35 USC § 103. It has been held that an *obvious-to-try* rationale exists where, "one of ordinary skill in the art would have to try each of numerous possible choices until one possibly arrived at a successful result where the prior art gave ...no direction as to which of the many possible choices is likely to be successful." *In re O'Farrell*, 7 USPQ2d 1673, 1681 (CAFC 1988). As there is no teaching of making metal oxide beads other than uranium oxide in Bezzi, the Examiner's argument requires that one of ordinary skill in the art specifically choose 'aluminum oxide' from a myriad of possible metal oxides without any guidance from the Bezzi disclosure. This argument is contrary to the proper standard of obviousness under 35 USC § 103.

The standard of obviousness under 35 USC § 103 requires that in order to render the claimed invention *prima facie* obvious, the prior art must suggest the claimed invention. Where a single reference (*i.e.*, primary reference) alone fails to suggest the claimed invention, that reference must provide some motivation that leads one of ordinary skill in the art to the teachings of one or more secondary references, which satisfy the deficiencies of the primary reference. Therefore, the combined teachings of

the primary and secondary references must suggest the claimed invention to establish a *prima facie* case of obviousness.

Applicants assert that in view of Bezzi's failure to teach or suggest (i) the formation of aluminum oxide beads, one of ordinary skill in the art would not have been motivated to consider the formation of aluminum oxide beads as claimed by applicants. Thus, one of ordinary skill in the art would not have been led to the secondary references cited by the Examiner, for a teaching of specifically making aluminum oxide beads.

Additionally, the Examiner's assertion that one of ordinary skill in the art of metal oxide formation would be well aware that aluminum oxide beads are routinely made by gelling droplets, and would, therefore, use the process of Bezzi to make aluminum oxide beads from an aluminum oxide precursor feed solution, is not supported by the Bezzi disclosure. The Examiner's assertion that the language of column 1, lines 8-9 and 49-50 suggests using Bezzi's process to make spherical particles of aluminum oxide for catalyst, because those familiar with metal oxide formation would know that catalyst supports are commonly made of aluminum oxide, is also not support by Bezzi.

Obviousness is a legal conclusion, that must be based on the facts of the record. *In re Fine*, 5 USPQ2d 1596, 1598 (CAFC 1988). Absent some suggestion, from the reference, to make the modification asserted by the Examiner, obviousness cannot be sustained based on the Examiner's assertion that the modification would have been obvious. *In re Soli*, 137 USPQ 797, 801 (CCPA 1963). Thus, since Bezzi fails to support the Examiner's assertion that it would have been obvious to make aluminum oxide beads, Bezzi also fails to render the present invention *prima facie* obvious.

Bezzi Does Not Teach Or Suggest The Claimed Vibrating Nozzle Plate

The present invention requires the presence of a vibrating annular nozzle plate having at least 10 droplet nozzles. Bezzi discloses a perforated disk (3) have a single hole from which the falling droplets of uranyl nitrate fall. Column 2, lines 56-61. There is no teaching or suggestion of the claimed vibrating nozzle plate. This assertion was made by applicants during a personal interview with the Examiner on August 5, 1999. The Examiner, however, rebutted this assertion by stating that Bezzi disclosed the use of a 'spinneret' (column 67-68) and, therefore, rendered the claimed vibrating nozzle plate obvious.

Applicants respectfully traverse this assertion because the term "spinneret', as disclosed by Bezzi, does not convey any information with respect to its *type* or *physical characteristics*, that would motivate one of ordinary skill in the art to modify the apparatus of Bezzi in a manner that would render obvious applicants' claimed vibrating nozzle plate. The Examiner has not indicated how the spinneret disclosed by Bezzi renders obvious the claimed vibrating nozzle plate. Absent some suggestion, from the reference, to make the modification asserted by the Examiner, obviousness cannot be sustained based on the Examiner's assertion that the modification would have been obvious. *Soli*, at 801.

Bezzi Does Not Teach Or Suggest Blowing Ammonia From The Interior Of The Annular Arrangement Of Droplet Nozzles

During the personal interview with the Examiner, applicants also stated that Bezzi was silent with respect to blowing ammonia gas from the interior of the annular arrangement of droplet nozzles. The Examiner rebutted these arguments, taking the

position that the falling droplets would pull air into the ammonia gas stream and thereby create turbulence, which would result in non-uniform contact of the ammonia gas with the falling droplets. Consequently, this non-uniform contact would allegedly result in non-uniform gelling of the falling droplets. The Examiner then concluded that it would have been obvious to modify the teaching of Bezzi to blow ammonia gas from the interior of the annular arrangement of droplet nozzles, in order to maintain uniform gelling of the falling droplets.

Applicants assert that nowhere in the Bezzi disclosure is there a teaching or suggestion supporting the Examiner's assertion. Absent such a teaching or suggestion, Bezzi can not render obvious blowing ammonia gas from the interior of an annular arrangement of droplet nozzles, as claimed by applicants. *Id.* Further, the single droplet stream of Bezzi does not accommodate blowing ammonia gas from an "interior" of an annular arrangement of droplet nozzles. There is also no guidance in Bezzi teaching or suggesting how one of ordinary skill in the art would accomplish blowing any gas from the interior of droplets falling from a spinneret.

Applicants Do Not Use Ammonia As A Reactant Gas

The present invention is further distinguished from the teaching Bezzi in that the ammonia gas through which the falling droplets of aluminum oxide pass, is not a reactant gas. Bezzi, however, specifically reacts the ammonia gas with the falling uranyl nitrate to initiate the chemical conversion of the uranyl nitrate to uranium oxide.

In contrast, the ammonia gas, as used in the present invention, is a gelling agent. More specifically, the ammonia gas of the present invention is a catalyst that initiates the

gelling (*i.e.*, pre-solidification) of the aluminum oxide on the outer surface of the falling droplet, which results in the formation of a solid aluminum oxide skin on the outer surface of the droplet.

Applicants presented this distinction to the Examiner during the personal interview, but the Examiner rejected it. The Examiner took the position that the ammonia gas of the present invention was a reactant gas participating an acid/base neutralization reaction, resulting in the formation of an aluminum salt. Contrary to the Examiner's assertion, however, applicants submit that the product of the present invention is not a salt. Nothing in applicants' specification supports the Examiner's assertion. The chemistry of the present invention, therefore, is distinct from that of the Bezzi disclosure. As such, Bezzi again, does not render obvious the present invention.

Thus, for the reasons discussed above, Bezzi fails to teach or suggest the formation of aluminum oxide beads, the use of a vibrating annular nozzle plate having at least 10 droplet nozzles, and blowing ammonia gas from the interior of the annular arrangement of the droplet nozzles. Thus, contrary to the Examiner's assertions, Bezzi alone does not render the present invention obvious.

Cited Secondary References Do Not Satisfy
The Deficiencies Of Bezzi

As discussed above, in view of the absence of any teaching or suggestion in Bezzi to make aluminum oxide particles, one of ordinary skill in the art would not have been motivated to seek out a method to specifically make aluminum oxide particles.

Thus, one of ordinary skill in the art would not have been led to the teachings of the secondary references cited by the Examiner.

Assuming, however, for the sake of argument that Bezzi does suggest the formation of aluminum oxide particles, which applicants assert is not the case, the secondary references cited by the Examiner are not combinable with Bezzi in a manner that would render the present invention obvious, because they fail to satisfy the deficiencies of Bezzi discussed above. The secondary references are discussed below.

Takumi and Sanchez

The Examiner cites claim 1 of both Takumi and Sanchez, alleging that the formation of aluminum oxide beads via drop forming methods is conventional and known to those of ordinary skill in the art. See Paper No. 33, page 4, lines 3-5. The Examiner concludes that it would have been obvious to one of ordinary skill in the art to use the Bezzi process, because both Takumi and Sanchez teach that aluminum oxide beads are routinely formed by drop methods, and that the final products of Takumi and Sanchez can be used as catalysts. A close reading of both Takumi and Sanchez, however, indicates that neither Takumi and Sanchez satisfy the deficiencies of Bezzi. Additionally, the disclosed processes of Bezzi, Takumi and Sanchez are substantially distinct from each other, and are, therefore, not combinable in a manner that would render the present invention obvious.

Takumi discloses a process for the formation of aluminum oxide using an oil drop method. In this method, an alumina hydrosol solution is mixed with a *gelling agent*, and

the mixed solution is formed into droplets which fall into a *oil suspending medium*, where the droplets are formed into a hydrogel, aged in the oil medium and then aged in an *aqueous ammonia solution*. See Takumi, column 3, lines 20-68.

Sanchez discloses a process for the formation of alumina particles by forming droplets of an alumina slurry, allowing the formed droplets to fall through air, and into a two phase liquid having a non-water miscible organic solvent containing ammonia upper phase on top of an aqueous alkaline coagulating agent lower phase. See Sanchez, column 16, lines 44-49. As the droplets pass through the upper phase they assume a spheroid shape, and as they pass through the lower phase they are coagulated into firm spheroid particles. *Id.* at lines 49-51.

In contrast, Bezzi prepares beads of uranium oxide by dropping droplets of uranyl nitrate through a reactant gas of ammonia to initiate the chemical conversion of uranyl nitrate to uranium oxide. The falling droplets then fall into a reactant solution of ammonium hydroxide, which completes the chemical conversion to uranium oxide. Thus, Bezzi is a materially different process from both Takumi and Sanchez.

Neither Takumi nor Sanchez teach or suggest the elements of the present invention missing from Bezzi. Specifically, there is no teaching or suggestion of the use of a vibrating annular nozzle plate having at least 10 droplet nozzles, and/or blowing ammonia gas against the falling droplets from the interior of the annular arrangement of droplet nozzles. Therefore, the combined disclosures of Bezzi, Takumi and Sanchez fail to render the present invention obvious.

Additionally, since the processes of Takumi and Sanchez are materially distinct from that of Bezzi, there is no suggestion that the material components of each process

are combinable. Specifically, Bezzi does not teach or suggest the desirability of combining the uranyl nitrate with a gelling agent, as disclosed by Takumi. There is also no, teaching or suggestion that the "oil", disclosed by Takumi, into which the alumina hydrosol droplets fall, can be substituted for the reactive ammonium hydroxide solution disclosed by Bezzi. Likewise, Bezzi does not teach or suggest the desirability of replacing the reactive ammonium hydroxide solution with a two phase liquid as disclosed by Sanchez. Lastly, there is no suggestion of eliminating the ammonia gas stream in Bezzi, as Takumi and Sanchez do not use an ammonia gas stream.

In order for a combination of references to render an invention obvious, the prior art must teach or suggest the desirability of making the combination. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 221 USPQ 929, 933 (Fed. Cir. 1984). Neither of Bezzi, Takumi or Sanchez suggests that their disclosures are combinable in the manner asserted by the Examiner. For this reason too, the combined disclosures of Bezzi, Takumi and Sanchez fail to render the present invention obvious.

Landis and De Haven

The Examiner asserts that the use of a ring of nozzles to provide a plurality of droplet streams in a drop tower is conventional and shown by Landis and De Haven. See Paper 33, page 4, lines 11-13. The Examiner concludes that it would have been obvious to one of ordinary skill in the art to replace the ring of nozzles disclosed by either of Landis or De Haven for the perforated disk (3) disclosed by Bezzi, because of the expected increase in production of the formed beads. *Id.* at lines 13-17. A close

reading of Landis and De Haven indicates, however, the disclosed processes teach away from the formation of aluminum oxide beads.

Landis discloses a process for producing beads of urea, from molten urea, which is sprayed through a nozzle, into a prilling tower containing a suitable gas atmosphere. As the molten urea droplets fall through the prilling tower, the droplets solidify, and collect on an air-fluidized bed at the bottom of the tower. The urea beads are then removed from the tower.

De Haven discloses a process for the production of ammonium nitrate beads, from a solution of ammonium nitrate. The ammonium nitrate solution is passed through a vibrating nozzle to form droplets of ammonium nitrate, which then fall through a prilling tower, having an air atmosphere contained therein. The falling droplets solidify during their descent and are collected at the bottom of the tower and are removed on a conveyor belt. While a vibrating nozzle plate is disclosed by De Haven, there is, however, no disclosure of the droplets falling through an ammonia atmosphere and then into an aqueous ammonia solution, as claimed by applicants.

Both Landis and De Haven disclose the formation of materially different compounds (*i.e.*, urea and ammonium nitrate) by materially different methods than disclosed by Bezzi, Takumi and Sanchez. Thus, Landis and De Haven teach away from the formation of aluminum oxide, and therefore, cannot be used to render the present invention obvious. The Court of Appeals for the Federal Circuit has held that where a reference leads one of ordinary skill in the art away from the claimed invention, that reference cannot render the claimed invention obvious. *Dow Chemical Co. v. American Cyanamide Co.*, 2 USPQ2d 1350, 1355 (CAFC 1987). Landis and De Haven, therefore,

are not combinable with the combination of Bezzi, Takumi and Sanchez, as discussed above.

CONCLUSION

In view of the above, applicants assert that the Examiner's conclusion of obviousness is based on the above-cited references disclosing isolated elements of applicants' present invention, and the combination of those elements to produce the claimed invention. It has been held, however, that citing references which merely indicate that isolated elements and/or features of the claimed invention are known in the art, is not a sufficient basis for concluding that the combination of those elements and/or features would have been obvious. *Ex parte Hiyamizu*, 10 USPQ2d 1393, 1394 (BPAI 1988). Further, obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. *In re Geiger*, 2 USPQ2d 1276, 1278 (CAFC 1987).

As the cited references fail to provide some teaching suggestion or incentive supporting the reference combination alleged by the Examiner, a *prima facie* case of obviousness has not been established. Reversal of the Examiner's conclusion of obviousness, withdrawal of the outstanding rejection and allowance of claims 19-27 are respectfully requested.

Respectfully submitted,

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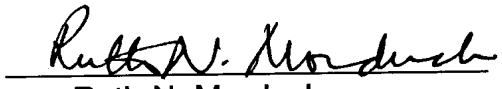
By 
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(9) Appendix Of Claims

19. A process for producing substantially spherical aluminum oxide beads, comprising the steps of:

(a) passing an acidic aluminum oxide sol or an acidic aluminum oxide suspension having a viscosity of 10 to 500 mP's through a vibrating nozzle plate so as to form falling hydrosol droplets,

wherein the nozzle plate is vibrated at a frequency of 10 Hz to 20,000 Hz, and has at least two droplet nozzles,

(b) laterally blowing ammonia gas against the falling droplets so that the surfaces of the falling droplets are substantially evenly gelled in a substantially spherical shape,

wherein the ammonia gas is carried through a narrow pipe which is laterally directed at the falling droplets and positioned a distance below the opening of said droplet nozzles;

(c) allowing the falling droplets to drop into an aqueous ammonia solution and coagulate to form substantially spherical aluminum beads;

(d) collecting the aluminum oxide beads from the aqueous ammonia solution.

ammonia solution.

e converting the collected beads to aluminum oxide

20. The process according to claim 19 which further comprises the step of drying the aluminum oxide beads.

21. The process according to claim 20, wherein the aluminum oxide beads are dried at a temperature of 20 - 300°C for 1 to 24 hours.

22. The process according to claim 19 which further comprises the step of calcining the aluminum oxide beads.

23. The process according to claim 22 wherein the aluminum oxide beads are calcined for 2-12 hours at 500 to 700°C.

24. The process according to claim 19 wherein aqueous ammonia solution contains a surface active agent for foam generation.

25. The process according to claim 19 wherein aqueous ammonia solution contains a foam of 5 to 20 mm depth on to improve bead shape.

26. A process for producing substantially spherical aluminum oxide beads comprising:

(a) passing an acidic aluminum oxide sol or an acidic aluminum oxide suspension having a viscosity of 10 to 500 mPa•s through a vibrating annular nozzle plate so as to form falling hydrosol droplets, wherein the annular nozzle plate is vibrated at a frequency of 10 Hz to 20,000 Hz and has at least ten droplet nozzles;

(b) laterally blowing ammonia gas against the falling hydrosol droplets so that the surfaces of the falling hydrosol droplets are substantially evenly gelled in a substantially spherical shape

wherein said droplet nozzles are arranged annularly and the ammonia gas is laterally blown against the falling droplets from the interior of the annular arrangement of the droplet nozzles, and said ammonia gas blown against said falling droplets is positioned a distance below the opening of said droplet nozzles;

(c) allowing the falling droplets to drop into an aqueous ammonia solution and coagulate to form substantially spherical aluminum oxide beads; and

(d) collecting the aluminum oxide beads from the aqueous ammonia solution.

27. The process of claim 19, wherein said droplet nozzles are arranged annularly and the ammonia gas is laterally blown against the falling droplets from the exterior of the annular arrangement of the droplet nozzles.